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ABSTRACT

Reported is a study to investigate the effectiveness of an instructional technique designed to enable preservice students enrolled in science methods courses to acquire skill in the use of nonverbal cues and the use of silence. Students were randomly assigned to experimental (9 students) and control (10 students) groups. The vehicle for skill development was microteaching, involving the use of peers as pupils for practicing the skill of set induction and of students at a local junior high school for the skill of probing questioning. The microteaching format involved viewing a model lesson on tape; five minutes of microteaching; review of the videotaped lesson by self, peers and supervisor; and reteaching a modified lesson to four new students. Analyses of data revealed that (1) student teachers who had practiced the use of nonverbal cues did devote significantly more time to nonverbal behaviors during student teaching; (2) there were no significant differences in the use of congruent behaviors exhibited by the experimental group during student teaching as compared to the control group; (3) teachers in the experimental group exhibited significantly (.05 level as measured by the calculated t) more positive nonverbal interactions with their students; and (4) the pupils of the student teachers did not perceive the members of the experimental group as being more effective than those of the control group. (Author/PEB)

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An Analysis of Nonverbal Behaviors Exhibited by Two Groups of Science Student Teachers

by

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Introduction

Some educational researchers have stated that an analysis of teacher verbal behavior provide an adequate sample of teacher classroom behavior. This belief may have evolved from the assumption that teachers are not exerting any influence upon students when they are silent or because teaching has often been equated with talking. For some, the image of an effective teacher has often focused upon the ability of a teacher to say the "right" thing.

Within the science classroom, the emphasis upon teacher-talk has diminished with a corresponding increase in attention paid to student inquiry techniques. Rather than being a dispenser of low level cognitive information, the new science curricula encourage teachers to use techniques focusing upon science as inquiry. Without instructions guiding the teacher in the development of these inquiry skills, the teacher often reverts to traditional teaching skills relying upon an ability to say the right thing. In this study, the effect of acquiring a skill in teaching without talking; namely, nonverbal cues and the use of silence during a preservice methods course was tested, and the roles which teachers play while silent analyzed.

Method

Preservice students enrolled in science methods courses during the fall and winter terms at Oregon State University were randomly assigned to an experimental and control group. All students were directed to prepare microlessons designed to acquire the teaching skills of set induction and probing questioning. The first skill was developed during the methods course at the university using peer group members as their microlesson students; however, probing questioning was developed at a local secondary school using junior high school level students as microclass members. In each case, the microteaching format was closely followed: this format included the viewing of a model tape exhibiting the skill; teaching a five minute lesson practicing the skill; review of the lesson including self evaluation of the videotape, peer group and supervisor feedback; and, reteaching the modified lesson to four new students. All lessons both at the university and junior high school were videotaped with the investigator acting as the microlesson supervisor.

Students assigned to the experimental group met with the researcher upon completion of the probing questioning sequence. The group was given a handout sheet explaining the skill of nonverbal cues including guidelines for developing the skill. This handout is in the Appendix. An informal discussion was held during which the researcher explained the use of nonverbal communication to increase the amount and quality of student participation and teacher-student interaction. Specific behaviors were emphasized to achieve these goals including eye contact, smiling, body position, body movement and gestures. Additional techniques to increase student participation were also explained including problem-solving, inquiry and the use of silence during a small group discussion. Students were encouraged to choose from among the alternative methods a technique which

they felt was consonant with their personality to achieve the desired teacher behavior. The model tape was viewed as illustrative of one technique of increasing student participation through nonverbal cues.

Again, the students were assigned to be microlesson teachers at the junior high school following the same procedure as that of probing questions. The lessons were taught to one group of junior high school students, critiqued by the supervisor and retaught to a second group of students.

While a total of 31 students completed the microlesson sequence, only 20 were assigned to student teaching during the winter and spring terms of 1971. These students were assigned to a total of 13 schools in seven school districts in Oregon. A summary of student teacher assignments is presented in Table 1.

Table 1

Classification of student teachers according to student teaching assignment

Junior High		Senior High		
Gen. Sci.	Biology	Biology	Chem.	Physics
7	1	5	4	3

Data Collection

Collection of data in this study necessitated that the researcher serve as the University supervisor during the student teaching experience. In addition to the normal responsibilities included in the supervision of any student teacher, the following data were obtained: (1) a record of student teacher interaction as measured by the %ALL (1); (2) student perception of teacher effectiveness as measured by the Teacher Demonstration Rating Form (TDRF) (2); and (3) an analysis of the teacher behavior manifested in one videotaped class session using the Biology Teacher Behavior Inventory (BTBI) (3); (4).

Two of the sources of data, student-teacher interaction and teacher behavior, necessitated the establishment of inter-observer agreement prior to the collection of data. Three class periods were simultaneously observed by the researcher and three cooperating teachers. Each observed interaction was coded as student-initiated or teacher initiated, verbal or nonverbal and whether they were positive, negative or neutral in affectivity. A value of .79 was computed for the %ALL between the researcher and the three cooperating teachers as a measure of observer agreement using the Scott Index of Inter-coder agreement (5).

Inter-observer agreement for the analysis of teacher behaviors as coded in the Biology Teacher Behavior Inventory was achieved by independently coding ten five-minute random samples of seven student teachers videotaped during the winter term. The coded behaviors were recorded second by second on a data record form. Initial agreement on two tapes was too low to establish reliability. However, re-examination of the behaviors manifested led each of the observers to recode one five-minute segment for a final value of .81.

Analysis of Teacher Behavior Using the BTBI

Upon establishment of inter-observer agreement, the videotapes were subsequently encoded, second by second. The first time the videotape was played, a mark was placed in the appropriate verbal, congruent, nonverbal or contradictory column of the data record sheet indicating the form of expression of the teacher behavior. A metronome was set to beat with a rhythm of 60 beats per minute and was used as the basis for encoding the second by second marks. The data record sheet was divided into ten second intervals to facilitate the encoding procedure. Key phrases or words were frequently noted on the page to guide the researcher in subsequent analysis. In addition, a numeral corresponding to the tabulated counter on the recorder was placed at the end of each page.

The videotape would then be replayed as many times as necessary to record the symbol of the behavior next to the dot indicating the time at which each behavior was recorded. Using this method, only one decision at a time; i.e., the mode of communication or the teacher behavior need to be identified. The total number of seconds which each teacher devoted to each category and subcategory was subsequently computed and converted to a percentage figure.

Pupil Perception of Teacher Effectiveness

The Teacher Demonstration Rating Form was administered to the secondary students within two weeks following the videotaping. The secondary students were told that student teachers from Oregon State University had participated in a special teacher preparation program. In order to evaluate the effectiveness of this program, the University needed to review evaluations from students of these teachers. In addition, the students were informed that the teachers would be allowed to review these evaluations, but would not be informed of the identity of the students.

The five choices on the form were assigned values representing a scale from minus two to plus two for each of the items. A socre was computed for each teacher and a total score for each of the two groups.

The Results

In this study,the hypotheses to be tested were as follows:

1. Teachers who have identified and practiced the skill of non-verbal cues during a methods class will devote significantly more time to nonverbal behaviors during their student teaching experience.
2. Teachers who have identified andpracticed the skill of nonverbal cues during a methods class will devote significantly more time to congruent behaviors with students during their student teaching experience.

3. Teachers who have identified and practiced the skill of nonverbal cues during a methods course will demonstrate significantly more positive nonverbal interactions with their students during their student teaching experience.
4. Teachers who have identified and practiced the skill of nonverbal cues will be perceived as more effective teachers by their students.

To test the first and second hypotheses, each of the teachers in the control and experimental group were videotaped one class period of their choice during his student teaching experience. The recorded teacher verbal and nonverbal behaviors were categorized second by second using the BTBI. The total number of seconds devoted by the teacher to each of the categories was computed. Subsequently, the total number of seconds was converted to percent of time allocated to each of the categories and subcategories in order to compare classes of unequal time periods.

All behaviors encoded for each teacher were encoded according to the various forms of expression including: "Verbal", "Congruent", "Nonverbal" and "Contradictory." Becuase the number of seconds devoted by the teachers in this study to contradictory behavior was neglible, these data were eliminated for statistical purposes. Table 2 shows the percentage of behaviors by teachers in this study in the various forms of expression.

Table 2

Percentage of behaviors by teachers in the various forms of expression

	Forms of Expression		
Teachers	Verbal	Congruent	Nonverbal
Experimental	15.95	39.38	44.07
Control	20.59	45.14	34.27

Because the assumptions underlying the use of parametric statistics could not be met, it was decided to use the nonparametric Mann-Whitney U

Test for a measure of between group differences. The procedure was to convert the total number of seconds devoted to verbal and congruent behaviors to percentages for each teacher within the two groups. The teachers were ranked across both groups on the basis of these scores and the ranks used to compute the value of U. In Table 3 the U values for the total percentage of congruent and nonverbal behaviors expressed by both groups of teachers are presented.

Table 3

U values for the congruent and nonverbal behaviors based upon experimental and control teachers

Expression	U Value	Significance
Congruent	47	N.S.
Nonverbal	31	.10

The hypotheses, as stated, were concerned with the experimental group manifesting more time devoted to nonverbal and congruent expressions of behavior. The probabilities of differences were based upon directional tests of significance. Reference to an appropriate table of probabilities revealed that the U value as presented in Table 3 was not significant for the percent of congruent behaviors expressed by the experimental group. The U value for the total percent of nonverbal behavior exhibited by the experimental group of student teachers was significant at the .10 level. Thus, Hypothesis 1 was accepted at the .10 level and Hypothesis 2 was rejected.

Hypotheses 3 and 4

In this study, the %ALL was used to encode teacher-student interactions which occurred between student teachers in science and individual students within their classes. The interactions were examined for information concerning the nature of the interactions which occur between the student

teachers and their students and the relationship between these interactions and the effectiveness of the student teacher as perceived by these students.

To test Hypothesis 3, the average number of teacher-initiated, positive, nonverbal interactions was calculated for each group of teachers. The means were subjected to a t test of significance. The results of this test is presented in Table 4.

Table 4

A comparison of group means for teacher-initiated positive nonverbal interactions

Group	Number	Variance	Mean Score	t
Control	10	9.07	2.2	2.25[a]
Experimental	10	5.75	4.9	

[a]Significant beyond .05 level

The calculated t was significant at the .05 level of probability. Thus, Hypothesis 3 was accepted. Teachers in the experimental group exhibited significantly more positive nonverbal interactions with students in their classrooms.

Hypothesis 4 states that teachers in the experimental group will be perceived as more effective teachers by their students as measured by the Teacher Demonstration Rating Form. The TDRF consisted of a five-point, forced choice rating scale on six items. The students were to evaluate the teachers presentation of lesson objectives, organization of content, classroom method and personal achievement. Each item was assigned a value from minus 2 to plus 2 and summed for a total score for each student. An average value was obtained by summing the scores for the entire class and dividing the calculated sum by the number of students in the class.

A mean value for teacher effectiveness was calculated for each group of teachers and subjected to a t test of significance for differences between two groups. The results of this test are presented in Table 5.

Table 5

A comparison of group means for teacher effectiveness between the two groups of teachers

Group	Number	Variance	Mean Share	t
Control	10	6.46	5.82	1.0 N.S.
Experimental	10	6.37	6.93	

N.S. - not significant

In this study, the teachers in the experimental group were not perceived as more effective teachers by their students.

In addition to the statistical tests of significance calculated for testing the hypotheses of the study, differences between the two groups of student teachers in classroom behaviors as measured by the BTBI were analyzed. For each group, a mean value for percentage of time devoted to each category, subcategory and subdivision of the BTBI was calculated. Using the Mann-Whitney U test (6), differences between the two groups were tested. In the Mann-Whitney U test, a rank is computed for each teacher based upon the percentage of time devoted to each behavior. Differences in ranks across the two groups were calculated in order to obtain a value for U which was compared to a table of probabilities. All teachers in this study did not exhibit all behaviors, and many teachers manifested the same percentage of time to other behaviors; hence, the computation of significant U values was hampered by the fact that "tied data" interfered with the assignment of meaningful ranks to the teacher.

The Mann-Whitney U test revealed that significant differences between the two groups existed within four categories of behavior. Inspection of the data revealed that the control group devoted significantly more time to: (1) "States Knowledge" - Verbal; (2) "States Knowledge - Congruent; and (3) "Shows Knowledge" - Congruent. The experimental group spent significantly more time in the category: "Positive Affectivity" - Nonverbal. A summary of U values for each of these categories is presented in Table 6.

Table 6

U values for categories designating differences between two groups of student teachers

Category	U Value	Significance Level
States Knowledge - Verbal	28.5	.10
States Knowledge - Congruent	20.0	.025
Shows Knowledge - Congruent	20.0	.025
Positive Affectivity - Nonverbal	31.0	.10

Analysis of Student Teacher Nonverbal Beahvicrs

Teacher nonverbal behavior comprised a significant portion of the classroom behavior of teachers in this study. A mean value of 44% of class time was devoted by the experimental teachers to nonverbal behaviors, while the control group spent 34% of their time in nonverbal activities. The patterns varied for teachers in this study, as would be expected. A summary of the total percentage of time devoted by each teacher in the study is presented in Table 7.

Table 7

The total percentage of time devoted by each teacher to nonverbal behaviors

Teacher*	% of Time	Teacher	% of Time
A	16.5	K	43.3
B	30.7	L	30.3
C	58.5	M	46.6
D	21.1	N	57.3
E	37.6	O	50.6
F	42.1	P	54.5
G	46.5	Q	59.0
H	22.5	R	36.1
J	41.3	S	22.0
		T	34.3

*Teachers A-J include teachers in the control group and teachers K-Y represent the experimental group

Of the total amount of time devoted to nonverbal behaviors, distinct patterns emerged for individual teachers. Upon analysis of data in Table 9, one may conclude that teachers vary in the total percent of time devoted to management activities and the types of management behaviors manifested. For example, Teacher "C" and "Q" both devoted approximately 59% of their time to nonverbal behaviors; however, for teacher "C" 38% of that time was occupied by management activities compared to only 7% exhibited by teacher "Q".

Table 8

The total percentage of time devoted to nonverbal management behaviors.

Teacher	1A	1B	1C	2	
	Classroom Management	Laboratory Management	Study Management	Control	Total
A	.59	2.01	0	0	2.60
B	10.14	0	6.01	.09	16.24
C	3.54	0	31.42	4.01	38.97
D	5.00	0	.90	0	5.90
E	1.36	13.80	.72	.48	16.36
F	5.58	0	13.33	.26	19.17
G	12.51	11.32	.81	.30	24.94
H	4.68	2.86	1.08	0	8.62
I	1.83	0	1.51	0	3.34
J	0	23.11	0	.32	23.43
K	1.74	6.41	10.58	.13	17.86
L	1.59	0	2.80	.51	4.90
M	14.44	0	5.48	4.03	23.95
N	1.86	21.84	7.63	.82	32.15
O	1.35	22.36	0	0	23.71
P	7.21	0	6.55	.47	14.23
Q	.49	0	2.47	3.65	6.61
R	5.38	3.17	.65	.47	19.57
S	2.86	0	1.73	0	4.59
T	3.91	0	2.09	0	6.00

classroom, the teachers exert a direct influence upon the teaching-learning experience; whereas, a student centered classroom is typically influenced by the development and investigation of student ideas.

In Table 9 the total percent of time devoted to subcategories within the category Content Development in a teacher centered classroom (5A) is presented.

Table 9

The total percentage of time devoted to teacher-centered content development activities

Teacher	1C Show Procedure	1D Acknowledge Procedure	2C Show Knowledge	2D Knowledge	3D Acknowledges Processi	7D Facilitates Communication	Total
A	0	.84	.54	1.93	5.28	2.56	3.15
B	.72	10.72	1.08	0	0	.63	11.43
C	0	0	1.17	6.43	0	.13	7.73
D	0	0	5.53	9.18	0	.53	15.24
E	0	1.44	.40	3.51	4.98	4.98	15.71
F	6.87	3.10	4.13	2.33	0	.52	16.95
G	0	0	3.18	5.09	1.82	.89	10.98
H	0	0	9.88	0	.14	1.97	11.99
I	0	0	2.72	14.60	2.76	1.83	21.91
J	0	1.26	0	2.09	2.52	2.96	8.83
K	5.35	3.78	0	0	2.55	0	11.68
L	1.07	.33	1.68	4.99	3.45	7.93	19.45
M	2.83	.48	5.84	8.54	0	1.50	19.19
N	.73	1.91	0	.77	1.18	1.00	5.59
O	3.19	.40	0	0	0	0	3.59
P	0	0	0	14.48	14.43	1.71	30.62
Q	0	.42	.49	1.67	8.64	.27	11.49
R	.25	.50	2.30	1.12	5.83	1.55	11.55
S	0	0	2.43	7.44	5.77	.22	15.86
T	0	0	.20	14.21	3.43	8.01	25.85

Visual inspection of the data reflect variations within and between groups of teachers. Many teachers exhibit a wide variety of behaviors indicative of many roles; others devote a significant proportion of their time to many fewer behaviors.

Assuming a role in a student centered classroom (5B) occupies very little of the time expressed as nonverbal behaviors for teachers in this study. Few of the teachers exhibited these behaviors; however, those who employed the technique often spent a substantial proportion of their time in this category. A summary of the percentage of time devoted to this category of nonverbal behavior is presented in Table 10.

Table 10

The total percentage of time devoted to student-centered content development activities.

Teacher	1D Acknowledges Procedure	2D Knowledge	3D Process	7D Facilitates Communication
A	0	0	0	0
B	0	0	0	0
C	0	0	0	0
D	0	0	0	0
E	0	0	0	0
F	0	0	0	0
G	0	0	0	0
H	5.56	0	0	1.38
I	0	0	0	0
J	0	0	0	0
K	0	0	0	0
L	3.78	1.91	0	0
M	0	0	0	0
N	0	10.85	2.18	.86
O	3.54	0	0	.54
P	15.34	0	0	0
Q	0	0	20.33	0
R	0	0	0	0
S	0	0	0	0
T	0	0	0	0

For differences between the two groups of teachers in this study to be statistically significant, the behavior under analysis must be exhibited by almost all of the teachers. While five teachers in the experimental group employed techniques which emphasized student inquiry, as compared to one teacher in the control group, one may not infer that the difference between the groups reflect treatment during the methods course. Utilizing a design incorporating a pre-post test would allow the researcher to compare differences helpful for drawing conclusions concerning this question.

Two additional nonverbal behaviors were illustrative in the categories entitled Goal Setting (4) and Positive Affectivity (6A). Goal setting, a category within which teachers exhibited behaviors indicative of naming or clarifying the objectives of the activity or course seemed to be a typical behavior for teachers

in this study. This may be accounted for by acquiring a skill in set induction; however, no statistical data could account for this inference.

The category of positive affectivity included behaviors more indicative of the experimental group. For those teachers, acquiring a skill in nonverbal cues during the preservice methods course contributed to an ability to exhibit the behavior during student teaching experience. A summary of the percentage of time devoted to these behaviors is presented in Table 11.

Table 11

The total percentage of time devoted to the categories of Goal Setting (4) and Positive Affectivity (6A) as nonverbal behaviors.

Teacher	4 Goal Setting	6A Positive Affectivity
A	1.42	1.34
B	.54	.76
C	11.05	.09
D	0	0
E	4.07	.40
F	5.53	.21
G	2.54	1.44
H	0	.42
I	2.83	.23
J	7.14	0
K	2.08	1.15
L	2.15	1.63
M	1.26	.72
N	1.73	.36
O	.45	2.74
P	2.04	3.42
Q	18.20	.52
R	.50	.14
S	1.08	0
T	.94	1.21

In conclusion, one may say that teachers play a variety of roles in the classroom by communicating through their nonverbal behaviors. For some of the teachers in this study, the acquisition of a skill in nonverbal cues and the use of silence contributed to the development of behaviors more consonant with the objectives of the newer science curricula. Student teachers who had not acquired a skill in nonverbal cues talked significantly more; moreover, the increase in talk

was consumed by behaviors representative of dispensing low-level cognitive information. Due to the variety of roles which a teacher assumes while not talking, analyses of teacher behavior which only include samples of teacher verbal behavior should be considered inadequate.

Appendix

Nonverbal Cues and the Use of Silence

The first task of the classroom teacher is communication. How a teacher is perceived by the student will depend upon the nature of the verbal and nonverbal messages which are communicated. The interactions between the teacher and learner will be determined to a great extend by how these communications are perceived by the student. Thus, while you may become sensitive to your nonverbal communications, you may never be able to evaluate the effect of these behaviors upon all students. In this skill we will attempt to:

1. increase student participation by decreasing teacher talk; and
2. isolate and practice some of the most obvious nonverbal cues.

Decreasing teacher talk will necessitate a decline in giving instructions, lecture, and the use of examples. Several possible techniques to accomplish this might include:

1. Presenting a problem to the students in the form of a slide, photograph, demonstration, news item or data to analyze.
2. Small group discussion.
3. Experiments are generally agreed to be problem solving activities.
4. Using certain nonverbal cues which will encourage students to ask question, respond, and to continue discussion.
   a. maintain silence after a student has spoken either as a question or response.
   b. hand movements may indicate "keep talking,"
   c. indicate a second student to respond to the first student.
5. Interact nonverbally with as many students as possible.

EVALUATION SHEET: SILENCE AND NONVERBAL CUES

Teacher_____ Date_____

Observer_____

Teach_____ Reteach_____

STUDENTS, SUPERVISORS, AND TEACHERS:

1. Did the teacher allow the students to do most of the talking?

2. Did the teacher remain quiet after asking a question, thus allowing the student time to think about his answer?

3. Did the teacher communicate with facial expressions, gestures, and body movements?

4. Was the teacher able to direct and control the discussion without speaking very often?

5. Was the teacher attentive? Did the teacher seem interested in what the students had to say?

6. Did the teacher make an effort to include as many students as possible in the discussion?

COMMENTS:

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